Catalogue of American Amphibians and Reptiles.

IVERSON, JOHN B. 1977. *Kinosternon subrubrum.*

Kinosternon subrubrum (Lacépède) Mud turtle

Testudo subrubra Lacépède, 1788:618. Type-locality, unknown; restricted to "vicinity of Philadelphia [Pennsylvania]" by Schmidt (1953). Holotype, collector, and date not stated.
Testudo pensylvanica Gmelin, 1788:1042. Type-locality, unknown; restricted to "vicinity of Philadelphia [Pennsylvania]" by Schmidt (1953). Holotype, collector, and date not stated.
Emys pensylvanica: Schweigger, 1812:283.
Terrapene Boscii Merrem, 1820:27. Type-locality, "America septentrionali" [North America]. Holotype, collector, and date not stated.
Terrapene pensylvanica: Merrem, 1820:27.
Cistuda pensylvanica: Say, 1825:206.
Sternotherus pensylvanica: Gray, 1825:211.
Kinosternon pennsylvanicum: Bell, 1825:304.
Sternothaerus Boscii: Bell, 1825:308.
Kinosternum pensylvanicum: Bonaparte, 1830:167.
Cinosternon pensylvanica: Wagler, 1830:137.
Cinosternon Pensylvanicum: Duméril and Bibron, 1834:567.
Kinosternon pensylvanicum: Dekay, 1842:21.
Kinosternon oblongum Gray, 1844:33. Type-locality, "America"; restricted to "vicinity of Philadelphia [Pennsylvania]" by Schmidt (1953). Cotypes, both males, British Mus. (Natur. Hist.) 1947.3.4.65–66, collected by E. Doubleday, date unknown (not examined by author).
Kinosternon Doubledayii Gray, 1844:33. Type-locality, "California" (in error); restricted to "vicinity of Philadelphia [Pennsylvania]" by Schmidt (1953). Holotype, a juvenile, British Mus. (Natur. Hist.) 1947.3.4.67, collected by E. Doubleday, date unknown (not examined by author).
Kinosternum Doubledayii: LeConte, 1854:190.
Kinosternon punctatum Gray, 1855:45. Type-locality, "East Florida." Holotype, a juvenile, British Mus. (Natur. Hist.) 1946. 1.22.30, collected by E. Doubleday, date unknown (not examined by author).
Kinosternon hippocrepis Gray, 1855:46. See subspecies synonymy.
Thyrosternum pennsylvanicum: Agassiz, 1857:428.
Cinosternon Doubledayii: Strauch, 1865:99.
Cinosternon hippocrepis: Strauch, 1865:100.
Swanka fasciata Gray, 1869:183. Type-locality, unknown; restricted to "vicinity of Philadelphia [Pennsylvania]" by Schmidt (1953). Holotype, a female, British Mus. (Natur. Hist.) 1946.1.22.92, collector and date unknown (not examined by author).
Cinosternum pennsylvanicum: Cope, 1875:52.
Cinosternon pennsylvanicum: Duges, 1888:15.
Cinosternum pensylvanicum: Boulenger, 1889:39.
Kinosternon louisianae Baur, 1893:676. See subspecies synonymy.
Kinosternon pensilvanicum: Lönnberg, 1894:319.
Cinosternum steindachneri Siebenrock, 1906:727. See subspecies synonymy.
Cinosternum pensilvanicum: Siebenrock, 1907:564.
Cinosternum louisianae: Ditmars, 1907:24.
Kinosternon subrubrum: Stejneger and Barbour, 1917:112.
Kinosternon steindachneri: Stejneger and Barbour, 1917:112.
Kinonsternon subrubrum: Liner, 1954:75.
Kinosternum subrubrum: Schwartz, 1961:16.

• CONTENT. Three subspecies are recognized: *Kinosternon subrubrum subrubrum*, *K. s. hippocrepis*, and *K. s. steindachneri*.

• DEFINITON. Adults are 80–125 mm in carapace length. The yellow or olive to black, adult carapace is oval, unserrated, and generally smooth, but may have a low median keel. Hatchlings have brown to black tricarinate carapaces with a yellow to orange spot on each marginal. The first vertebral does not contact the second marginal; the ninth marginal is not elevated above the preceding marginals. The length and width of the second vertebral is nearly equal; posterior ones are usually wider than long. The plastron has two well-developed transverse moveable hinges bordering the abdominal scutes. Adult plastral color ranges from yellow with brown seams to almost completely brown. The hatchling's plastron varies from yellow to reddish-orange with a brown to black medial foliate pattern applied to the seams. Eleven plastral scutes, including a small gular, are present. The plastron is notched posteriorly in all but the smallest individuals. The axillary scute contacts the inguinal. The skin is brown to gray, unconspicuously marked. The head markings vary considerably. The basic pattern consists of two white, yellow, or orange lines extending posteriorly from the orbit; one above and one below the tympanum. The stripes are often broken into linear series of spots or random mottling. Males have larger heads than females; longer, thicker tails; deeper posterior plastral notches; and a patch of tuberculate scales on the posterior surfaces of each crus and thigh. Both sexes have a spine-tipped tail.

• DESCRIPTIONS. General descriptions are in Boulenger (1889), Ditmars (1907), Cahn (1937), McCauley (1945), Carr and Goin (1955), Duellman and Schwartz (1958), Ernst and Barbour (1972) and Conant (1975). Hatchlings are described in McCauley (1945), Nichols (1947), and Sabath (1960); eggs, in Brimley (1903) and Cahn (1937). More detailed descriptions include secondary sexual differences (Grant, 1935); osteology (White, 1929); cervical vertebrae (Williams, 1950); plastral anatomy (Fichter, 1969; Richmond, 1964; Shah, 1960); carapacial seam arrangements (Tinkle, 1962); shield abnormalities (Zangerl and Johnson, 1957); rostral pores (Winokur and Legler, 1974); cranial arteries (McDowell, 1961; Albrecht, 1967); embryonic pineal eye (Fetterolf, 1887); musk glands (Waagen, 1972); penial morphology (Zug, 1966); lung capacity (Agassiz, 1857); and karyotype (Forbes, 1966).

• ILLUSTRATIONS. Color photographs of adults appear in Breen (1967), Pritchard (1967), Barbour (1971), Leviton (1971) and Ernst and Barbour (1972); those of young, in Conant (1975). Ditmars (1907), Cahn (1937), Pope (1939), Conant (1947), Carr (1952), Carr and Goin (1955), Barbour (1971), Ernst and Barbour (1972), and Conant (1975) provide black and white photographs of adults; Carr (1952), of the juvenile; Pope (1939), Conant (1947), and Möller (1962), the hatchling; Cahn (1937), the eggs; and Ernst and Barbour (1972), the skull. Drawings of adults are found in Gray (1831, 1872), Holbrook (1842), Dekay (1842), Hay (1887), Siebenrock (1907), Babcock (1919), Schwartz (1961) and Wermuth and Mertens (1961); those of the young, Gray (1872). More specific drawings appear in Agassiz (1857, eggs and young); Siebenrock (1906, plastron; 1907, skull); White (1929, shell osteology); Holman (1963, hypoplastral elements); Richmond (1964, hatchling plastron); Zug (1966, penis); and Bellairs (1969, plastron).

• DISTRIBUTION. *Kinosternon subrubrum* is restricted to the eastern half of the United States; it ranges from eastern Texas and eastern Oklahoma eastward to the Appalachians, along the Gulf coastal plain to Florida, and northward along the Atlantic coastal plain to southeastern New York and possibly southwestern Connecticut. Disjunct populations are recorded in western Missouri (Anderson, 1942), western Illinois (Smith, 1961), and northwestern Indiana (Grant, 1935; Stille, 1947; among others). Two Carnegie Museum specimens (CM 26725 and 37221) from the Florida Keys were originally identified as *K. subrubrum*. The former is lost (Duellman and Schwartz, 1958), and the latter, erroneously the basis of Conant's (1975) Keys record, I have



MAP. The solid circles mark the type localities; open circles show other localities. The stars indicate fossil localities. Overlapping patterns indicate areas of intergradation.

identified as *K. baurii*. I believe *subrubrum* does not naturally occur on the Keys.

• Fossil Record. Fossils are reported from the Pleistocene by Weigel (1962: Florida Wisconsinian) and from the Pliocene by Fichter (1969: Kansas Hemphilian); archaelogical remains from the Columbian period of Florida are discussed in Hirschfeld (1969).

• Pertinent Literature. General accounts are in Ditmars (1907), Viosca (1923), Cahn (1937), Carr (1940), Duellman and Schwartz (1958), Smith (1961), Anderson (1965), Skorepa and Ozment (1968), Mahmoud (1969), Ernst and Barbour (1972), Ernst *et al.* (1972), and Conant (1975). Other important references are listed by topics: taxonomy (Siebenrock, 1907; Wermuth and Mertens, 1961; Frair, 1972; Ernst *et al.*, 1974); general reproduction (Cahn, 1937; Skorepa and Ozment, 1968; Gibbons, 1972; Mahmoud and Klicka, 1972; Lardie, 1975); mating behavior (Nichols, 1947; Barkalow, 1948; Anderson, 1965; Mahmoud, 1967); function of stridulating organs (DeSola, 1931; Mahmoud, 1967); nesting (Brimley, 1903; Wright and Funkhouser, 1915; Carr, 1940; Richmond, 1945; McCauley, 1945; Nichols, 1947; Carr, 1952; Parmalee, 1955; Tinkle, 1959); incubation and hatching (McCauley, 1945; Lynn and Von Brand, 1945; Sabath, 1960); growth (Skorepa and Ozment, 1968; Mahmoud, 1969; Ernst *et al.*, 1973); longevity (Flower, 1937; Pope, 1939; Nigrelli, 1954; Jarvis, 1961); movements (Strecker, 1908, 1926; Mahmoud, 1969; Gibbons, 1970; Bennett *et al.*, 1970; Bennett, 1972); occurrence in salt water (review in Neill, 1958); hibernation (Wetmore and Harper, 1917; Babcock, 1919; Neill, 1948; Bennett, 1972); predation (Nichols, 1914; Hamilton and Pollack, 1956; Murphy, 1964); food and feeding behavior (Strecker, 1927; Cahn, 1937; Pritchard, 1963; Mahmoud, 1968; Ernst and Ernst, 1969); agonistic behavior (Spoczynska, 1969; Rigley, 1974); habits in captivity (Strecker, 1927; Pope, 1939; Reyst, 1953; Bustard, 1961; Breen, 1967; Spoczynska, 1969); biogeography (Viosca, 1926; Smith, 1957; Smith and Minton, 1957; Neill, 1957; Auffenberg and Milstead, 1965); radioactive exoskeletal burdens (review in Jackson *et al.*, 1974); algal relationships (Edgren *et al.*, 1953; Neill and Allen, 1954; Proctor, 1958; Dixon, 1960; Ernst and Barbour, 1972); parasites (see bibliographies in Hughes *et al.*, 1942, and Ernst and Barbour, 1972); temperature requirements (Mahmoud, 1969); moisture requirements (Bogert and Cowles, 1947); color selection (Ernst and Hamilton, 1969; Hailman and Jaeger, 1971); serology (Morgan and Singh, 1969; review in Frair, 1972); blood chemistry (Helmy *et al.*, 1969; review in Dessauer, 1970); parathyroid (review in Clark, 1970); excretion (Moyle, 1949).

• Etymology. The specific name *subrubrum* is from the Latin *sub*, meaning below and *ruber*, meaning red and refers to the red-orange plastron of hatchlings. The subspecifi name, *steindachneri*, honors Franz Steindachner, a Vienna herpetologist. The subspecific name, *hippocrepis*, is from the Greek *hippos* for horse and *krepis* for shoe and refers to the head stripe pattern.

1. *Kinosternon subrubrum subrubrum* (Lacépède)

Testudo subrubra Lacépède, 1788:618–619. See species synonymy.
Testudo pensylvanica Gmelin 1788:1042. See species synonymy.
Kinosternon oblongum Gray, 1844:33. See species synonymy.
Kinosternon Doubledayii Gray, 1844:33. See species synonymy.
Kinosternon punctatum Gray, 1855:45. See species synonymy and Remarks.
Swanka fasciata Gray, 1869:183. See species synonymy.
Kinosternon subrubrum subrubrum: Stejneger and Barbour, 1917: 112. First use of combination.

• Diagnosis. This race differs from *steindachneri* and *hippocrepis* by occasional (30%) presence of distinct facial stripes. The plastron and bridge are longer (75–101% and 13–22% of carapace length), and posterior plastral lobe wider (45–53% of CL) than in *steindachneri*. The interabdominal seam is shorter (20–26% of CL) than in *hippocrepis* and the nasal scale is seldom (10%) forked posteriorly.

• Remarks. *Kinosternon punctatum* is here considered a synonym of *K. s. subrubrum*, although the type locality suggests that it may prove to be a senior synonym of *K. steindachneri*.

2. *Kinosternon subrubrum hippocrepis* Gray

Kinosternon hippocrepis Gray, 1855:46. Type-locality, "North America, New Orleans [Louisiana]." Cotypes, both juveniles, British Mus. (Natur. Hist.) 1946.1.22.16–17, collected by E. Doubleday, date unknown (not examined by author).
Kinosternon louisianae Baur, 1893:676. Type-locality "New Orleans, Louisiana." Holotype, a female, U. S. Nat. Mus. 15527, collected in 1883 by R. W. Shufeldt (examined by author).
Kinosternon subrubrum hippocrepis: Stejneger and Barbour, 1917:112.

• Diagnosis. The head stripes are always present. The plastral midlobe and interabdominal seam are longer (24–31% and 22–31% of CL) than in *subrubrum* and *steindachneri*. The nasal scale is seldom (< 3%) forked posteriorly.

3. *Kinosternon subrubrum steindachneri* (Siebenrock)

Cinosternum steindachneri Siebenrock, 1906:727. Type-locality, "Orlando, Florida." Syntypes, British Mus. (Natur. Hist.) 1946.1.22.23 (a male), 1946.1.22.24 (a female); data accompanying specimens reads "St. Petersburg, Florida," collector and date unknown (not examined by author).
Kinosternon subrubrum steindachneri: Carr, 1940:99.

• Diagnosis. This race differs from *hippocrepis* and the nominate subspecies in the shorter plastron and bridge (73–90% and 6–14% of carapace length), the narrower posterior plastral lobe (38 to 49% of CL), an absence of well-defined head stripes, and the usual occurrence (> 75%) of a posteriorly forked nasal scale.

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